

**Groundfish of the
Bering Sea and Aleutian Islands Area:
Species Profiles 2000**

by
David Witherell



North Pacific Fishery Management Council
605 West 4th Avenue, Suite 306
Anchorage, AK 99501

January 3, 2000

Table of Contents

Walleye Pollock	1
Pacific cod	2
Yellowfin sole	3
Greenland turbot	4
Arrowtooth flounder	5
Rock sole	6
Flathead sole	7
Other flatfish	8
Sablefish	9
Pacific ocean perch	10
Other rockfish	11
Atka mackerel	12
Squid	13
Other species	14

Acronyms and Definitions

ABC	= acceptable biological catch
AI	= Aleutian Islands
BSAI	= Bering Sea and Aleutian Islands
BS	= Bering Sea
CDQ	= community development quota
c/p	= catcher processor
CVOA	= catcher vessel operational area
EBS	= Eastern Bering Sea
EEZ	= exclusive economic zone
F	= instantaneous fishing mortality rate
FMP	= fishery management plan
H&G	= headed and gutted fish
IFQ	= individual fishing quota
M	= instantaneous natural mortality rate
m	= meters
mt	= metric tons
OFL	= overfishing level
OY	= optimum yield
POP	= Pacific ocean perch
TAC	= total allowable catch

Walleye Pollock

Biology: Pollock (*Theragra chalcogramma*) is the most abundant groundfish species in the BSAI. Pollock begin to recruit to the fishery at age 4 and many survive 10 years or more. Females reach 50% maturity at 39 cm (about 4 years old) and produce 60,000 to 400,000 pelagic eggs. Spawning occurs in April in the Eastern Bering Sea (EBS). Annual natural mortality of adults has been estimated to be about 25% ($M = 0.30$). Seasonal migrations occur from overwintering areas along the outer shelf to shallow waters (90-140 m) to spawn. Pollock are found throughout the water column from the surface down to 500 m. Pollock feed on copepods, euphausiids, and fish (primarily juvenile pollock), and are in turn prey for other fish, marine mammals, and seabirds.

Stock Assessment: The current assessment of EBS pollock is based on a statistical age-structured model. Estimates of B_{msy} and F_{msy} have been estimated to be 1,790,000 mt and 0.50, respectively. Projected spawning biomass for 2000 is 2,160,000 mt. OFL and ABC rates are based on tiers defined under Amendment 56.

Population Status: The overall population has remained above or near the B_{msy} level. For 2000, exploitable biomass (age 3+) in the Eastern Bering Sea was projected at 7.7 million mt. Catch specifications were the following: OFL=1,680,000 mt, ABC=1,139,000 mt, TAC=1,139,000 mt. The stock increased due to recruitment of an above average 1996 year class. Exploitable biomass is expected to further increase in 2001.

! Not Overfished
! Above Target Biomass
! Increasing Stock Size

Fishery: Pollock are targeted by trawl gear, but small numbers are also taken as bycatch by longline gear. Participants in the directed 1998 BSAI fishery included 100 catcher vessels and 38 catcher-processors.

Management: The BSAI Pollock fishery is regulated under the BSAI Groundfish FMP. The FMP controls the fishery through permits and limited entry, catch quotas (TACs), seasons, in-season adjustments, gear restrictions, closed waters, bycatch limits and rates, allocations, regulatory areas, record keeping and reporting requirements, and observer monitoring. Pollock TAC has recently been allocated into four separate seasons to reduce potential for competition with Steller sea lions. Ten percent of the TAC is allocated to CDQ groups. The remaining TAC has been divided between inshore and offshore harvesters. Beginning in 1999 under the American Fisheries Act, 50% is allocated to catcher vessels delivering inshore, 40% to catcher processors for processing offshore, and 10% to catcher vessels delivering to motherships. All pollock caught must be retained for processing.

Economics: Two-thirds of the total ex-vessel value of groundfish in the BSAI is from pollock. In 1999, 1,100,000 mt of pollock was caught in the Eastern Bering Sea, of which over 99% was retained. Average ex-vessel price was about \$0.10 per pound. Primary products produced are surimi, fillets, meal, and to a lesser extent mince, roe, and other products.

Catch History: With the decline in yellowfin sole abundance in the early 1960's, and the development of surimi processing, fishing effort in the BSAI shifted to pollock. Catches increased to over 1 million mt from 1970-1976. The fishery was prosecuted primarily by Japan (80% of the catch), and to a lesser extent the USSR. Korean vessels began participating in this fishery in 1976. Joint ventures of the early 1980's were phased out by domestic fleet by 1991. Catches have remained relatively stable for the past 20 years.

Age 3+ biomass (mt, hindcast from 1999 Model 2 analysis), pre-season catch specifications (mt), and total catches (mt, including discards) of pollock in the EBS, 1980-2000.

Year	EBS Biomass	EBS ABC	EBS TAC	EBS Catch
1980	3,888,000	1,300,000	1,000,000	958,279
1981	8,064,000	1,300,000	1,000,000	973,505
1982	9,229,000	1,300,000	1,000,000	955,964
1983	10,153,000	1,300,000	1,000,000	982,363
1984	9,685,000	1,300,000	1,200,000	1,098,783
1985	11,370,000	1,300,000	1,200,000	1,179,759
1986	10,440,000	1,300,000	1,200,000	1,188,449
1987	10,769,000	1,300,000	1,200,000	1,237,597
1988	9,991,000	1,500,000	1,300,000	1,228,000
1989	8,305,000	1,340,000	1,340,000	1,230,000
1990	6,497,000	1,450,000	1,280,000	1,353,000
1991	4,842,000	1,676,000	1,300,000	1,268,360
1992	7,800,000	1,490,000	1,300,000	1,384,376
1993	9,873,000	1,340,000	1,300,000	1,301,574
1994	8,622,000	1,330,000	1,330,000	1,362,694
1995	8,817,000	1,250,000	1,250,000	1,264,578
1996	7,147,000	1,190,000	1,190,000	1,189,296
1997	5,710,000	1,130,000	1,130,000	1,124,593
1998	5,961,000	1,110,000	1,110,000	1,101,165
1999	7,513,000	992,000	992,000	978,000
2000	7,700,000	1,139,000	1,139,000	*

Pacific Cod

Biology: Pacific cod (*Gadus macrocephalus*), also known as grey cod, are moderately fast growing and short-lived fish. Females reach 50% maturity at 67 cm (about 5.8 years old) and are highly fecund. A 67 cm cod will produce well over 1 million eggs. Spawning occurs January through April in the Bering Sea. Annual natural mortality of adults has been estimated to be about 30 ($M = 0.37$). Cod prey on clams, worms, crabs, shrimp, and juvenile fish. In turn, they are eaten by halibut and marine mammals. Cod are demersal and concentrate on the shelf edge and upper slope (100-250 m) in the winter, and move to shallower waters (generally <100 m) in the summer. Cod begin to recruit to trawl fisheries at age 3, but are not fully recruited to all gear types until about age 7. Maximum age has been estimated at 18 years based on otolith samples.

Stock Assessment: The current assessment is based on a length-based Synthesis model. Estimates of B_{msy} and F_{msy} are not available for this stock. OFL and ABC rates are based on tiers defined under Amendment 56. Under this definition, 2000 OFL for Pacific cod was based on a tier 3b fishing mortality rate where $F_{OFL} = F_{35\%adjusted} (=0.33)$. ABC was based on a tier 3b harvest strategy where $F_{ABC} = F_{40\%adjusted} (=0.28)$, and was further reduced by 6% based on a risk-averse optimization procedure.

Population Status: For 2000, exploitable biomass (age 3+) was projected at 1.300 million mt. Catch specifications were the following: OFL=240,000 mt, ABC=193,000 mt, TAC=193,000 mt. The stock has declined due to poor year-classes produced in 1993, 1994, and 1995. A continued decline is projected, as the 1996 year-class looks to be about average and the 1997 year class well below average.

! Not Overfished
! Below Target Biomass
! Decreasing Stock Size

Fishery: Cod are taken with trawl, longline, pot and jig gear. Participants in the 1998 BSAI fishery included 58 hook and line vessels, 78 pot vessels, and 121 trawl vessels. The 1999 directed Pacific cod fishery was prosecuted from approximately January 20 to April 11 for catcher trawlers, January 20 through May 6 (catcher processors), January 1 through April 17 (H&L), and April 1 through June 9 for by pot gear vessels. Most trawling and pot fishing occurs north and west of Unimak Island, whereas most effort by longline vessels occurs along the slope north and west of the Pribilof Islands.

Management: The BSAI Pacific cod fishery is regulated under the BSAI Groundfish FMP. The FMP controls the fishery through permits and limited entry, catch quotas (TACs), seasons, in-season adjustments, gear restrictions, closed waters, bycatch limits and rates, allocations, regulatory areas, record keeping and reporting requirements, and observer monitoring. Pacific cod TAC is allocated among gear types (51% to longline and pot gear, 47% to trawls, and 2% to jig gear) under Amendment 46. Of the trawl gear allocation, a 50/50 split is made for catcher vessels and catcher-processors. Seven and one-half percent of the TAC is allocated to CDQ groups. Beginning in 1998, all Pacific cod caught must be retained for processing.

Economics: Total ex-vessel value of BSAI Pacific cod was \$137 million in 1997. In 1998, 195,000 mt of BSAI Pacific cod was caught, of which about 98% was retained. Average ex-vessel price was about \$0.25 per pound. Primary products produced are H&G and fillets, and to a lesser extent salted, whole fish, and other products (roe, mince, etc.).

Catch History: Pacific cod were taken by Japanese longline and trawl operations beginning in the early 1960's. By 1970, catches had reached 70,000 mt. Vessels from the USSR entered the fishery in 1971, and together these two countries harvested an average of 50,000 mt from 1971-1976. Foreign fisheries were replaced by joint ventures in the early 1980's, which were phased out by domestic fleet by 1988. Catches have fluctuated at about 170,000 mt since 1985.

Biomass (mt, from survey data), pre-season catch specifications (mt), and total catches (mt, including discards) of Pacific cod in the BSAI, 1980-2000.

Year	EBS Biomass	BSAI ABC	BSAI TAC	BSAI Catch
1980	905,000	148,000	70,700	51,649
1981	1,035,000	160,000	78,700	62,458
1982	1,021,000	168,000	78,700	56,566
1983	1,176,000	298,200	120,000	93,167
1984	1,001,000	291,300	210,000	133,160
1985	961,000	347,400	220,000	145,426
1986	1,134,000	249,300	229,000	140,887
1987	1,142,000	400,000	280,000	157,746
1988	959,000	385,300	200,000	197,891
1989	960,000	370,600	230,681	168,918
1990	709,000	417,000	227,000	171,008
1991	532,000	229,000	229,000	172,158
1992	547,000	182,000	182,000	206,129
1993	690,000	164,500	164,500	167,390
1994	1,368,000	191,000	191,000	196,572
1995	1,003,000	328,000	250,000	233,029
1996	891,000	305,000	270,000	240,590
1997	605,000	306,000	270,000	234,641
1998	534,000	210,000	210,000	195,648
1999	583,000	177,000	177,000	160,000
2000	*	193,000	193,000	*

Yellowfin Sole

Biology: Yellowfin sole (*Limanda aspera*) are relatively slow growing and long-lived fish species. Females reach 50% maturity at 30 cm (about 10.5 years old) and are highly fecund, producing one to three million eggs. Spawning occurs in June and July in shallow waters of Bristol Bay to Nunivak Island. Annual natural mortality of adults has been estimated to be about 10% ($M = 0.12$). Prey includes benthic infauna and epifauna, euphausiids, and fish. Yellowfin sole concentrate on the outer shelf in the winter, and move to very shallow waters (<30 m) to spawn and feed in the summer. Yellowfin sole begin to recruit to trawl fisheries at age 6, but are not fully recruited to all gear types until about age 13. Maximum age for this species is 31 years.

Stock Assessment: The current assessment includes abundance estimates from NMFS bottom trawl surveys, cohort analysis, and Stock Synthesis model. Estimates of B_{msy} and F_{msy} are not available for this stock. OFL and ABC rates are based on tiers defined under Amendment 56. Under this definition, OFL for yellowfin sole is based on a tier 3a fishing mortality rate where $F_{OFL} = F_{35\%}$ ($=0.13$). ABC is based on a tier 3a harvest strategy where $F_{ABC} = F_{40\%}$ ($=0.11$).

Population Status: For 2000, exploitable biomass is projected to be 2.82 million mt. Catch specifications were the following: OFL=226,000 mt, ABC=191,000 mt, TAC=123,262 mt. The stock has recently been at record high levels due to good recruitment in the early 1970's and low exploitation. Biomass is projected to remain stable in coming years.

! Not Overfished
! Above Target Biomass
! Stable Stock Size

Fishery: Yellowfin sole are targeted primarily by trawl catcher-processors. The 1996 directed yellowfin sole fishery was prosecuted from approximately January 20 through October. Seasons are generally limited by seasonal apportionments of halibut. Fishing occurs throughout the shelf area.

Management: Yellowfin sole is regulated under the BSAI Groundfish FMP. The FMP controls the fishery through permits and limited entry, catch quotas (TACs), seasons, in-season adjustments, gear restrictions, closed waters, bycatch limits and rates, allocations, regulatory areas, record keeping and reporting requirements, and observer monitoring. Harvests have been constrained by halibut bycatch limits, crab bycatch limits, and the 2 million mt BSAI OY cap. Seven and one-half percent of the TAC is allocated to CDQ groups. Under Amendment 49, all yellowfin sole caught must be retained for processing beginning in 2003.

Economics: All BSAI flatfish species, including yellowfin sole, produced a total ex-vessel value of \$55 million in 1997. In 1999, 67,000 mt of yellowfin sole was caught, of which about 55,000 mt was retained. Average ex-vessel price for flatfish was about \$0.13 per pound. Primary products produced are whole fish, H&G, and kirimi.

Catch History: Yellowfin sole were overexploited by foreign fisheries in 1959-1962, when catches averaged about 400,000 mt. As a result of reduced abundance, annual catches declined to about 100,000 mt through the late 1960's to 50,000 mt in the 1970's. Abundance increased in the 1980's, resulting in increased catch by foreign and joint-venture operations. The fishery became fully domestic in 1991.

Total biomass (mt, from Survey data), pre-season catch specifications (mt), and total catches (mt, including discards) of yellowfin sole in the BSAI, 1980-2000.

Year	EBS Biomass	BSAI ABC	BSAI TAC	BSAI Catch
1980	1,842,000	169,000	117,000	87,391
1981	2,394,000	214,500	117,000	97,301
1982	3,377,000	214,500	117,000	95,712
1983	3,535,000	214,500	117,000	108,385
1984	3,141,000	310,000	230,000	159,526
1985	2,443,000	310,000	229,900	227,107
1986	1,909,000	230,000	209,500	208,597
1987	2,613,000	187,000	187,000	181,429
1988	2,402,000	254,000	254,000	223,156
1989	2,316,000	241,000	182,675	153,165
1990	2,183,000	278,900	207,650	80,584
1991	2,393,000	250,600	135,000	96,135
1992	2,172,000	372,000	235,000	146,946
1993	2,465,000	238,000	220,000	105,809
1994	2,610,000	230,000	150,325	144,544
1995	2,009,000	277,000	190,000	124,746
1996	2,298,000	278,000	200,000	130,163
1997	2,163,000	233,000	230,000	181,389
1998	2,329,000	220,000	220,000	95,036
1999	1,306,000	212,000	207,980	67,000
2000	*	191,000	123,262	*

Greenland Turbot

Biology: Greenland turbot (*Reinhardtius hippoglossoides*) are relatively fast growing species. Females reach 50% maturity at 60 cm (about 9 years old) and produce about 60,000 to 80,000 eggs. Spawning occurs in October through December. Greenland turbot feed on crustaceans, squid, and a variety of fish species. Annual natural mortality of adults has been estimated to be about 15% ($M = 0.18$). Greenland turbot spend their juvenile years (until age 4) on the continental shelf, then move to the slope. Yellowfin sole begin to recruit to longline fisheries at 60 cm and are fully recruited until about 90 cm. Maximum lifespan is 21 years.

Stock Assessment: The current Greenland turbot assessment is based on a Stock Synthesis model. Estimates of B_{msy} and F_{msy} are not available for this stock. OFL and ABC rates are based on tiers defined under Amendment 56.

Population Status: Exploitable biomass in the BSAI was projected at 233,000 mt for 2000. Catch specifications were the following: OFL=42,000 mt, ABC=9,300 mt, TAC=9,300 mt. The stock biomass peaked in the early 1970s, followed by a persistent decline to current levels due to poor recruitment. Biomass is projected to remain low in the foreseeable future due to small year-classes produced in the 1980's and 1990's.

! Not Overfished
! Above Target Biomass
! Decreasing Stock Size

Fishery: Greenland turbot has been targeted by trawl and longline gear. The 1997 directed fishery was prosecuted longline vessels from May 1-September 15 in the Bering Sea. Significant amounts are also retained as bycatch in other fisheries. Most fishing occurs along the shelf edge and slope, as well as along the Aleutian Islands.

Management: The BSAI turbot fishery is regulated under the BSAI Groundfish FMP. The FMP controls the fishery through permits and limited entry, catch quotas (TACs), seasons, in-season adjustments, gear restrictions, closed waters, bycatch limits and rates, allocations, regulatory areas, record keeping and reporting requirements, and observer monitoring. Beginning in 1998, no halibut PSC was apportioned to the trawl fishery for this target, consequently no directed turbot fishing has been allowed with trawl gear.

Economics: Turbot is a valuable species. In 1999, a total of 5,800 mt of Greenland turbot was caught in the BSAI, of which about 5,100 mt was retained.

Catch History: Prior to implementation of the MFCMA, Greenland turbot were targeted by the Japanese, and to a lesser extent the USSR. Annual catches of Greenland turbot averaged about 30,000 mt during the 1960s. Catches increased to 60,000 mt in 1974, and remained in the 50,000 mt range through 1983. Catch has remained at or below 10,000 mt since 1986.

Total biomass (mt, age 1+ hindcast from 1999 Synthesis model), pre-season catch specifications (mt), and total catches (mt, including discards) of Greenland turbot in the BSAI, 1980-2000.

Year	Biomass	ABC	TAC	Catch
1980	684,000	76,000	90,000	52,553
1981	663,000	59,800	90,000	57,321
1982	634,000	60,000	90,000	52,122
1983	601,000	65,000	90,000	47,558
1984	563,000	47,500	59,610	23,120
1985	540,000	44,200	37,100	14,731
1986	519,000	35,000	33,000	9,864
1987	499,000	20,000	20,000	9,599
1988	478,000	14,100	11,200	7,108
1989	460,000	20,300	8,000	8,822
1990	439,000	7,000	7,000	9,620
1991	415,000	7,000	7,000	6,878
1992	390,000	7,000	7,000	2,770
1993	375,000	7,000	7,000	8,468
1994	356,000	7,000	7,000	10,379
1995	334,000	7,000	7,000	8,193
1996	313,000	10,300	7,000	6,376
1997	293,922	12,350	9,000	7,536
1998	272,000	15,000	15,000	8,856
1999	251,000	14,200	9,000	5,800
2000	233,000	9,300	9,300	*

Arrowtooth Flounder

Biology: Arrowtooth flounder (*Atheresthes stomias*) are a relatively large flatfish that may live to 15 years. Size and age of sexual maturity are not known at this time. Spawning occurs from December through February. Annual natural mortality of adults has been estimated to be about 15% ($M = 0.20$). Arrowtooth flounder are distributed throughout the continental shelf through age 4, and then at older ages disperse to occupy both the shelf and the slope.

Stock Assessment: The current assessment includes abundance estimates from NMFS bottom trawl surveys, cohort analysis, and Stock Synthesis model. Estimates of B_{msy} and F_{msy} are not available for this stock. OFL and ABC rates are based on tiers defined under Amendment 56. Under this definition, OFL for arrowtooth flounder is based on a tier 3a fishing mortality rate where $F_{OFL} = F_{35\%}$ ($=0.27$). ABC is based on a tier 3a harvest strategy where $F_{ABC} = F_{40\%}$ ($=0.22$).

Population Status: Exploitable biomass of BSAI Arrowtooth was projected to be 785,000 mt for 2000. Catch specifications were the following: OFL=160,000 mt, ABC=131,000 mt, TAC=131,000 mt. The huge increase in biomass observed in the 1990's resulted from strong year-classes produced from 1980-89. The stock is expected to decline slightly in the future, as recent year-classes have been average (1990-1993, 95, 96), or below average (1991-92).

! Not Overfished
! Above Target Biomass
! Decreasing Stock Size

Fishery: Little to no effort is directed to catching arrowtooth flounder. Arrowtooth are taken as bycatch by trawl and longline gear in pursuit of other high valued species. Prior to 1996, arrowtooth may have served as "ballast" against allowable retainable bycatch of species such as Greenland turbot and sablefish.

Management: Arrowtooth is regulated under the BSAI Groundfish FMP. The FMP controls the fishery through permits and limited entry, catch quotas (TACs), seasons, in-season adjustments, gear restrictions, closed waters, bycatch limits and rates, allocations, regulatory areas, record keeping and reporting requirements, and observer monitoring. Arrowtooth was managed with Greenland turbot as a species complex until 1986. Seven and one-half percent of the TAC is allocated to CDQ groups.

Economics: Arrowtooth is a very low valued species. In 1999, 10,000 mt of arrowtooth flounder was caught in the BSAI, of which all but 2,000 mt was discarded. Average ex-vessel price remains very low. Primary products produced from arrowtooth is meal, although a process has been developed to make surimi.

Catch History: Arrowtooth flounder and Greenland turbot were managed as a complex until 1986. Consequently, catch records for these species were combined during the 1960s and 1970s. Because the Greenland turbot fishery intensified during the 1970's, it is generally assumed that catches of arrowtooth flounder also increased. Catches of arrowtooth averaged about 15,000 mt from 1976 through 1983, and declined through the 1980's. Higher catches in more recent years are a result of higher biomass levels, and corresponding incidental catch in other target fisheries.

Total biomass (mt, from EBS trawl survey), pre-season catch specifications (mt), and total catches (mt, including discards) of Arrowtooth flounder in the BSAI, 1980-2000.

Year	EBS Biomass	BSAI ABC	BSAI TAC	BSAI Catch
1980	47,800	20,000	N/A	18,364
1981	49,500	16,500	N/A	17,113
1982	67,400	16,500	N/A	11,518
1983	149,300	20,000	N/A	13,969
1984	182,900	20,000	N/A	9,452
1985	159,900	20,000	N/A	7,375
1986	232,100	20,000	20,000	6,903
1987	290,600	30,900	9,795	4,539
1988	306,500	99,500	5,531	5,883
1989	410,700	163,700	6,000	3,222
1990	459,200	106,500	10,000	4,232
1991	329,200	116,400	20,000	13,686
1992	414,000	82,300	10,000	11,980
1993	543,600	72,000	10,000	9,298
1994	570,600	93,400	10,000	14,377
1995	480,800	113,000	10,227	9,015
1996	556,400	129,000	9,000	14,610
1997	478,600	108,000	20,760	10,054
1998	344,900	147,000	16,000	14,930
1999	243,000	140,000	134,354	10,000
2000	*	131,000	131,000	*

Rock Sole

Biology: Rock sole (*Lepidopsetta bilineata*) is a moderately slow growing fish. Females reach 50% maturity at about age 9. Spawning occurs March through June in the Bering Sea. Annual natural mortality of adults has been estimated to be about 15% ($M = 0.20$). Rock sole prey on benthic invertebrates, and are in turn prey for marine mammals. Rock sole occur throughout the shelf (<250 m), and are particularly abundant in the Bristol Bay area. Recruitment to trawl fisheries occurs at age 4, but rock sole are not fully recruited until age 11. Maximum age for rock sole is about 20 years.

Stock Assessment: The current assessment for rock sole is based on a stock assessment model using AD model builder. Estimates of B_{msy} and F_{msy} are not available for this stock. OFL and ABC rates are based on tiers defined under Amendment 56. Under this definition, OFL for rock sole is based on a tier 3a fishing mortality rate where $F_{OFL} = F_{35\%}$ ($=0.19$). ABC is based on a tier 3a harvest strategy where $F_{ABC} = F_{40\%}$ ($=0.15$).

Population Status: Exploitable biomass of rock sole was projected to be 2.07 million mt for 2000. Catch specifications were the following: OFL=273,000 mt, ABC=230,000 mt, TAC=134,760 mt. Biomass increased in the 1990's due to strong year-classes produced from 1980-87 and in 1990. The stock is expected to decline slightly in the future, as recent year-classes have been average (1988, 93), or below average (1989, 91, 92, 94, 95).

! Not Overfished
! Above Target Biomass
! Declining Stock Size

Fishery: Rock sole are targeted primarily by trawl catcher-processors, and to a lesser extent shoreside and mothership operations. The rock sole fishery is directed at roe-bearing females from January 20 to about mid-March. Most fishing effort for this species occurs in outer Bristol Bay and the area north of Unimak Island.

Management: The rock sole fishery is regulated under the BSAI Groundfish FMP. The FMP controls the fishery through permits and limited entry, catch quotas (TACs), seasons, in-season adjustments, gear restrictions, closed waters, bycatch limits and rates, allocations, regulatory areas, record keeping and reporting requirements, and observer monitoring. Harvests have been constrained by halibut and crab bycatch limits. Rock sole was formerly included in the "other flatfish" complex until 1989. Seven and one-half percent of the TAC is allocated to CDQ groups. Under Amendment 49, all rock sole caught must be retained for processing beginning in 2003.

Economics: Rock sole have been targeted for high valued roe. Females are processed by H&G, with roe intact. Disproportionately high discards of males and juveniles have occurred. In 1999, 40,000 mt of rock sole was caught, of which about 15,000 mt was retained. Primary products produced are H&G with roe-in, and to a lesser extent kirimi.

Catch History: Rock sole were harvested by Japanese and Soviet vessels beginning in 1963. Foreign catches increased from about 7,000 mt annually from 1963-1969, and peaked at 61,000 mt in 1972. Catches were reduced until joint-venture operations participated beginning in 1980. Thereafter, catches increased to 86,000 mt in 1988. The fishery was fully domestic by 1990, and recent catches have remained stable at about 30,000 to 60,000 mt per year.

Total biomass (mt, from survey data), pre-season catch specifications (mt), and total catches (mt, including discards) of rock sole in the BSAI, 1980-2000.

Year	EBS Biomass	BSAI ABC	BSAI TAC	BSAI Catch
1980	284,000	N/A	N/A	8,798
1981	302,000	N/A	N/A	9,021
1982	579,000	N/A	N/A	11,844
1983	713,000	N/A	N/A	13,618
1984	799,000	N/A	N/A	18,750
1985	700,000	N/A	N/A	37,678
1986	1,031,000	N/A	N/A	23,483
1987	1,270,000	N/A	N/A	40,046
1988	1,480,000	N/A	N/A	86,366
1989	1,139,000	171,000	90,762	68,912
1990	1,381,000	216,300	60,000	35,253
1991	1,588,000	246,500	90,000	46,681
1992	1,543,000	260,800	40,000	51,956
1993	2,123,000	185,000	75,000	64,260
1994	2,894,000	313,000	75,000	60,584
1995	2,175,000	347,000	60,000	55,083
1996	2,183,000	361,000	70,000	47,146
1997	2,711,000	296,000	97,185	67,564
1998	2,169,000	312,000	100,000	33,454
1999	1,689,000	309,000	120,000	40,000
2000	*	230,000	137,760	*

Flathead Sole

Biology: Flathead sole (*Hippoglossoides ellassodon*) are distributed from northern California northward throughout Alaska. Spawning occurs February through May in the Bering Sea. Annual natural mortality of adults has been estimated to be about 15% ($M = 0.20$). Flathead sole prey on benthic invertebrates such as crustaceans, mollusks, and brittle stars, long with fish and squid. Flathead sole overwinter along the outer shelf, and move to shallower waters (20-180 m) in the spring. Recruitment to trawl fisheries generally occurs at age 3, although some age 2 fish are taken. Flathead sole may live 16 years or more.

Stock Assessment: The current assessment for flathead sole is based on NMFS trawl survey abundance estimates. Estimates of B_{msy} and F_{msy} are not available for this stock. OFL and ABC rates are based on tiers defined under Amendment 56. Under this definition, OFL for flathead sole is based on a tier 3a fishing mortality rate where $F_{OFL} = F_{30\%}$ ($=0.35$). ABC is based on a tier 3a harvest strategy where $F_{ABC} = F_{40\%}$ ($=0.28$).

Population Status: Exploitable biomass of flathead sole was projected at 611,000 mt for 2000. Catch specifications were the following: OFL=90,000 mt, ABC=73,500 mt, TAC=52,652 mt. The huge increase in biomass observed in the 1980's and 1990's resulted from strong year-classes produced from 1977-87. The stock is expected to decline slightly in the future, as recent year-classes have been average (1989), or below average (1988, 1990-96).

! Not Overfished
! Above Target Biomass
! Declining Stock Size

Fishery: Flathead sole are targeted primarily by trawl catcher-processors, and to a lesser extent shoreside and mothership operations. The flathead sole fishery begins on January 20, and occurs periodically with release of halibut PSC.

Management: The flathead sole fishery is regulated under the BSAI Groundfish FMP. The FMP controls the fishery through permits and limited entry, catch quotas (TACs), seasons, in-season adjustments, gear restrictions, closed waters, bycatch limits and rates, allocations, regulatory areas, record keeping and reporting requirements, and observer monitoring. Harvests have been constrained by halibut bycatch limits. Flathead sole was formerly included in the "other flatfish" complex until 1995. Seven and one-half percent of the TAC is allocated to CDQ groups.

Economics: In 1999, 18,000 mt of flathead sole was caught, of which about 14,000 mt was retained. Primary products produced are H&G with roe-in, and to a lesser extent kirimi.

Catch History: Japanese and Soviet vessels began fishing for flathead sole, along with other flatfish in 1963, when 30,000 mt were taken. Catches fell off to only 7,000 mt in 1965, but then increased to a peak of 51,000 mt in 1971. Catches declined to 15,000 mt in 1975, and remained under 10,000 mt until 1990 when catches of flathead sole peaked at 20,000 mt. Recent catch levels are indicative of increased bycatch rates in other fisheries (corresponding to higher biomass) and developing markets.

Total biomass (mt, from EBS trawl survey), pre-season catch specifications (mt), and total catches (mt, including discards) of flathead sole in the BSAI, 1980-2000.

Year	EBS Biomass	BSAI ABC	BSAI TAC	BSAI Catch
1980	117,500	N/A	N/A	5,247
1981	162,900	N/A	N/A	5,218
1982	192,200	N/A	N/A	4,509
1983	269,000	N/A	N/A	5,240
1984	285,900	N/A	N/A	4,458
1985	276,300	N/A	N/A	5,636
1986	357,900	N/A	N/A	5,208
1987	394,800	N/A	N/A	3,595
1988	549,500	N/A	N/A	6,783
1989	519,600	N/A	N/A	3,604
1990	593,500	N/A	N/A	20,245
1991	570,300	N/A	N/A	15,602
1992	618,100	N/A	N/A	14,239
1993	610,200	N/A	N/A	13,664
1994	725,100	N/A	N/A	18,455
1995	593,400	138,000	30,000	14,452
1996	616,400	116,000	30,000	17,344
1997	807,800	101,000	43,500	20,704
1998	692,200	132,000	100,000	24,228
1999	395,000	77,300	77,300	18,000
2000	*	73,500	52,652	*

Other Flatfish

Biology: The current "other flatfish" category is dominated by one species, Alaska plaice (*Pleuronectes quadrituberculatus*). Less than 10% of this complex consists of miscellaneous flatfish species such as rex sole and Dover sole. Annual natural mortality of adults has been estimated to be about 15% ($M = 0.20$). This flatfish species is thought to live 16 years or more. Alaska plaice begin to recruit to trawl fisheries at age 4, but are not fully recruited to all gear types until about age 7.

Stock Assessment: The current assessment for "other flatfish" is based on a SAM model using AD model builder. Estimates of B_{msy} and F_{msy} are not available for this stock complex. OFL and ABC rates are based on tiers defined under Amendment 56. Under this definition, 2000 OFL for "other flatfish" is based on a tier 3a fishing mortality rate where $F_{OFL} = F_{35\%} (=0.35)$. ABC is based on a tier 3a harvest strategy where $F_{ABC} = F_{40\%} (=0.28)$.

Population Status: Exploitable biomass (age 4+) of "other flatfish" was projected to be 829,000 mt for 2000. Catch specifications were the following: OFL=147,000 mt, ABC=117,000 mt, TAC=83,813 mt. It is expected that the stock will decline in abundance in coming years. Aging data have indicated a series of strong year-classes increased biomass to a peak in the mid 1980's. Average, or below average year-classes have been produced since 1982, and as such the stock is projected to decline.

! Not Overfished
! Above Target Biomass
! Declining Stock Size

Fishery: Other flatfish are harvested by trawl vessels, particularly by catcher-processors.

Management: The "other flatfish" complex is regulated under the BSAI Groundfish FMP. The FMP controls the fishery through permits and limited entry, catch quotas (TACs), seasons, in-season adjustments, gear restrictions, closed waters, bycatch limits and rates, allocations, regulatory areas, record keeping and reporting requirements, and observer monitoring. Harvests have been constrained by halibut bycatch limits and the 2 million mt BSAI OY cap. Rock sole were broken out from the "other flatfish" complex in 1989 and flathead sole were broken out in 1995. Seven and one-half percent of the TAC is allocated to CDQ groups.

Economics: All flatfish species, including other flatfish, produced a total ex-vessel value of \$ 55 million in 1997. In 1999, 15,000 mt of other flatfish was caught, of which about 10,000 mt was retained. Average ex-vessel price for flatfish was about \$0.16 per pound. Primary products produced are whole fish, H&G, and kiriti.

Catch History: Japanese and Soviet vessels began fishing for flathead sole, along with other flatfish in 1963, when 30,000 mt were taken. Catches fell off to only 7,000 mt in 1965, but then increased to a peak of 51,000 mt in 1971. Catches declined to less than 20,000 mt in the mid-1970s. Since implementation of the MFCMA in 1977, catches have been comprised primarily of Alaska plaice, and have been reported separately. Catch of Alaska plaice and miscellaneous flatfish peaked in 1988 at 67,00 mt.

Total biomass (mt, from EBS trawl survey), pre-season catch specifications (mt), and total catches (mt, including discards) of "other flatfish" in the BSAI, 1980-2000.

Year	EBS Biomass	BSAI ABC	BSAI TAC	BSAI Catch
1980	410,500	61,000	61,000	7,558
1981	623,800	92,500	61,000	9,189
1982	819,300	92,500	61,000	7,456
1983	796,300	119,200	61,000	11,596
1984	843,600	150,200	111,490	21,078
1985	613,000	150,200	111,400	27,865
1986	592,700	137,500	124,200	47,637
1987	612,100	193,300	148,300	20,517
1988	759,700	331,900	131,369	67,425
1989	576,600	155,900	75,183	15,636
1990	559,900	188,000	60,150	11,890
1991	623,100	219,700	64,675	19,069
1992	581,900	199,600	79,000	19,963
1993	602,400	191,000	79,000	15,409
1994	677,200	225,000	56,000	13,990
1995	590,100	117,000	19,540	20,348
1996	590,000	102,000	35,000	21,440
1997	714,000	97,500	50,750	22,871
1998	527,000	164,000	89,434	15,338
1999	616,000	154,000	154,000	15,000
2000	*	117,000	83,813	*

Sablefish

Biology: Sablefish (*Anoplopoma fimbria*), also known as blackcod, is a long lived fish with a maximum life span of 62 years. Females reach 50% maturity at 65 cm (about 6 years old), producing up to 1 million pelagic eggs. Spawning occurs in February in the Bering Sea. Annual natural mortality of adults has been estimated to be about 10% ($M = 0.10$). Average age of recruitment is 5 years. Sablefish concentrate on the continental slope (100-1,000 m). Sablefish feed on benthic invertebrates, squid, and numerous fish species. In turn, they are prey for halibut, lingcod, and marine mammals such as sea lions. Killer whales have been known to take sablefish from longline gear as it is being retrieved.

Stock Assessment: A combined assessment for sablefish in the BSAI and GOA is based on an age structured model using AD model builder. Estimates of B_{msy} and F_{msy} are not available for this stock. OFL and ABC rates are based on tiers defined under Amendment 56. Under this definition, 2000 OFL for sablefish is based on a tier 3b fishing mortality rate where $F_{OFL} = F_{35\% \text{ adjusted}}$ ($=0.14$). ABC is based on a tier 3b harvest strategy where $F_{ABC} = F_{40\% \text{ adjusted}}$ ($=0.11$).

Population Status: Exploitable biomass was projected to be 18,000 mt in the EBS and 33,000 mt in the AI for 2000. Catch specifications were the following: OFL=1,750 mt (EBS), 3,090 mt (AI); ABC=1,470 (EBS); 2,430 mt (AI), TAC=1,470 (EBS); 2,430 mt (AI). The stock had declined due to low recruitment from 1982 though the mid 1990's, but appears to have stabilized at a low biomass level.

! Not Overfished
! Below Target Biomass
! Stable Stock Size

Fishery: Sablefish are taken with trawl, longline, and pot gear. The 1996 directed BSAI sablefish fishery was prosecuted by 1 trawl vessel and 47 hook and line vessels. The fixed gear season begins March 15, concurrent with the halibut fishery.

Management: The BSAI sablefish fishery is regulated under the BSAI Groundfish FMP. The FMP controls the fishery through permits and limited entry, catch quotas (TACs), seasons, in-season adjustments, gear restrictions, closed waters, bycatch limits and rates, allocations, regulatory areas, record keeping and reporting requirements, and observer monitoring. The sablefish TAC is allocated among gear types (50% to fixed gear and 50% to trawl gear in the BS; 75% to fixed gear and 25% to trawl gear in the AI). The fixed gear apportionment is managed by the IFQ program. Twenty percent of the BSAI fixed gear sablefish quota is allocated to CDQ communities.

Economics: Sablefish is a high valued resource in the BSAI, worth \$68 million ex-vessel in 1997. In 1999, 1,150 mt of BSAI sablefish was caught, of which nearly all was retained. Average ex-vessel price was about \$2.25 per pound for fixed gear fisheries, and \$1.04/lb for trawl fisheries. The primary product produced is H&G.

Catch History: Sablefish was targeted by Japanese freezer longliners since 1959. BSAI catches peaked in 1962 when 28,500 mt were harvested. From 1963 to 1972, an average of about 13,000 mt of sablefish were caught, with the USSR entering the fishery in 1967. Catches dropped to less than 5,000 mt in 1974. A small peak occurred in 1987 when 8,000 mt were landed. Landings have since been reduced.

Exploitable biomass (mt, hindcast from 1999 Synthesis model), pre-season catch specifications (mt), and total catches (mt, including discards) of sablefish in the BSAI, 1980-2000.

Year	BSAI+GOA Biomass	BS+AI ABC	BS+AI TAC	BS+AI Catch
1980	186,000	3,700	5,000	2,480
1981	281,000	3,700	5,000	3,137
1982	308,000	2,900	5,000	4,139
1983	329,000	2,900	5,000	3,368
1984	401,000	6,185	5,340	3,328
1985	443,000	6,080	4,500	3,796
1986	425,000	7,200	6,450	6,546
1987	400,000	7,700	7,700	8,012
1988	387,000	9,200	8,400	6,608
1989	347,000	6,200	6,200	4,500
1990	308,000	7,200	7,200	4,445
1991	262,000	6,300	6,300	3,207
1992	265,000	4,400	4,400	2,104
1993	237,000	4,100	4,100	2,747
1994	253,000	3,340	3,340	2,470
1995	239,000	3,800	3,800	1,968
1996	223,000	2,500	2,300	1,349
1997	208,000	2,675	2,300	1,657
1998	220,000	2,680	2,680	1,188
1999	234,000	3,200	3,200	1,150
2000	220,000	3,900	3,900	*

Pacific Ocean Perch and Other Red Rockfish

Biology: Pacific ocean perch (*Sebastes alutus*), often called by their acronym POP, are a slow growing and long-lived fish. Females reach 50% maturity at 29 cm (about 7 years old). Females are viviparous, meaning they retain fertilized eggs within the ovary until larval extrusion. In the BSAI, mating takes place in the late fall, and larval extrusion occurs in the early spring. Maximum life span is 90 years. Annual natural mortality of adults has been estimated to be about 5% ($M = 0.05$). Pacific ocean perch inhabit the outer continental shelf and upper slope regions (100-400m) and are generally found over cobble substrate. Recruitment to trawl fisheries starts at age 5, but Pacific ocean perch are not fully recruited until about age 8. The "Other Red Rockfish" complex consists of northern rockfish, rougheye rockfish, shortraker rockfish and sharpchin rockfish. Like POP, these rockfish are long lived and slow growing. Maximum age observed is 120 years for shortraker and 140 years for rougheye rockfish. As such, natural mortality is low ($M = 0.06$ for northerns, $M = 0.03$ for shortraker, and $M = 0.025$ for rougheye). Sharpchin rockfish are not common in the BSAI.

Stock Assessment: The current Pacific ocean perch assessment is based on a Stock Synthesis approach, tuned to the trawl survey abundance estimates. Estimates of B_{msy} and F_{msy} are not available for this stock complex. OFL and ABC rates are based on tiers defined under Amendment 56. Under this definition, 2000 OFL for Pacific ocean perch in the eastern Bering Sea is based on a tier 3b fishing mortality rate where $F_{OFL} = F_{35\%adjusted} = 0.065$. ABC is based on a tier 3b harvest strategy where $F_{ABC} = F_{40\%adjusted} = 0.054$. For the Aleutian Islands POP stock, $F_{OFL} = F_{35\%adjusted} = 0.083$, and $F_{ABC} = F_{40\%adjusted} = 0.070$. OFL and ABC for other red rockfish is based on a tier 5 fishing rate, whereby $F_{OFL} = M$, and $F_{abc} = 0.75 \times M$.

Population Status: Exploitable biomass of POP in 2000 was projected to be 47,700 mt in the EBS and 192,000 mt in the AI. Catch specifications for the EBS were the following: OFL=3,100 mt, ABC=2,600 mt, TAC=2,600 mt. Catch specifications for the AI POP stock were: OFL=14,400 mt, ABC=12,300 mt, TAC=12,300 mt. Several above average year-classes were produced during the 1980s in the AI area, which increased the stock somewhat in this area.

! Not Overfished
! Below Target Biomass
! Stable Stock Size

Fishery and Management: Pacific Ocean perch are taken primarily by trawl catcher-processors. The fishery is regulated under the BSAI Groundfish FMP. The FMP controls the fishery through permits and limited entry, catch quotas (TACs), seasons, in-season adjustments, gear restrictions, closed waters, bycatch limits and rates, allocations, regulatory areas, record keeping and reporting requirements, and observer monitoring. Beginning in 1991, the POP complex was subdivided into separate groups to protect against overfishing of higher valued component species. Beginning in 1996, POP TAC was further subdivided among AI areas. Seven and one-half percent of the TAC is allocated to CDQ groups.

Economics: Pacific Ocean perch and other red rockfish are a relatively high-value resource. In 1999, 12,000 mt of POP was caught, of which about 10,500 mt was retained. In addition, 6,000 mt of other red rockfish was caught. Average ex-vessel price of rockfish was about \$0.18 per pound. Primary products produced are H&G and whole fish.

Catch History: Pacific ocean perch supported major Japanese and Soviet trawl fisheries throughout the 1960's. In the Bering Sea, catches peaked in 1961 (47,000 mt); the Aleutian Islands catch peaked in 1965 (109,000 mt). Stocks and catches declined reaching their lowest levels in the mid-1980s. Joint-venture fisheries of the 1980's were replaced by the domestic fleet by 1990. Since then, catches have been 12,000 - 20,000 mt per year.

Exploitable biomass (mt, ages 9+, hindcast from 1999 Synthesis), pre-season catch specifications (mt), and total catches (mt, including discards) of Pacific Ocean Perch in the BSAI, 1980-2000. Specifications and catch includes POP and other red rockfish.

Year	AI Biomass	BS+AI ABC	BS+AI TAC	BS+AI Catch
1980	38,000	18,000	10,750	5,797
1981	38,000	18,000	10,750	4,844
1982	38,000	18,000	10,750	1,238
1983	40,000	11,800	10,750	501
1984	46,000	12,160	4,480	2,200
1985	63,000	12,760	4,800	1,092
1986	78,000	10,200	11,025	846
1987	101,000	14,700	11,025	1,934
1988	106,000	22,600	11,000	3,026
1989	118,000	22,600	11,000	4,723
1990	153,000	22,900	12,900	20,289
1991	148,000	21,700	21,700	7,289
1992	175,000	23,530	23,530	13,586
1993	186,000	25,520	24,630	17,138
1994	188,000	21,100	21,100	18,866
1995	199,000	20,640	19,811	15,944
1996	200,000	22,360	21,514	15,682
1997	206,000	21,948	21,948	13,475
1998	202,000	18,962	18,962	14,528
1999	198,000	20,862	20,362	18,000
2000	192,000	21,129	21,129	*

Other Rockfish

Biology: The other rockfish complex contains *Sebastolobus* and *Sebastes* species other than Pacific ocean perch. As with most rockfish, these are slow growing and long-lived species. Shortspine thornyheads (*Sebastolobus alascanus*) account for about 90% of the other rockfish complex biomass. Little is known about this species in the

BSAI. In the Gulf of Alaska, females reach 50% maturity at 22 cm. Maximum life span is 60 years. Annual natural mortality of adults has been estimated to be about 5% ($M = 0.07$). Thornyheads are a deepwater demersal fish, inhabiting the continental shelf edge and slope. Recruitment to longline fisheries starts at age 15, and are fully recruited at age 30. Full recruitment to trawl fisheries occurs at age 22.

Stock Assessment: The current assessment for "other rockfish" is based on trawl survey abundance indices. Estimates of B_{msy} and F_{msy} are not available for this stock complex. OFL and ABC rates are based on tiers defined under Amendment 56. Under this definition, the 2000 OFL and ABC for "other rockfish" in the eastern Bering Sea is based on a tier 5 fishing rate, whereby $F_{OFL} = M$, and $F_{abc} = 0.75 \times M$.

Population Status: For 2000, exploitable biomass of "other rockfish" was projected to be 7,030 mt in the EBS and 13,000 mt in the AI. Catch specifications for the EBS were the following: OFL=492 mt, ABC=369 mt, TAC=369 mt. Catch specifications for the AI stock were: OFL=913 mt, ABC=685 mt, TAC=685 mt.

! Not Overfished
! Target Biomass Unspecified
! Stock Trend unknown

Fishery: In recent years, thornyheads catches have been mainly incidental to other directed trawl and longline fisheries. Participants in 1998 BSAI rockfish fisheries included 8 c/p trawl vessels, 2 c/p longliners, and 10 catcher longliners. Other rockfish remained on bycatch status during 1995-99.

Management: The "other rockfish" complex is regulated under the BSAI Groundfish FMP. The FMP controls the fishery through permits and limited entry, catch quotas (TACs), seasons, in-season adjustments, gear restrictions, closed waters, bycatch limits and rates, allocations, regulatory areas, record keeping and reporting requirements, and observer monitoring. Prior to 1980, "other rockfish" were included in the Pacific Ocean Perch complex. Seven and one-half percent of the TAC is allocated to CDQ groups.

Economics: In 1999, about 760 mt of other rockfish was caught, of which about half was retained. Average ex-vessel price of rockfish has been about \$0.18 per pound. Primary products produced are H&G and whole fish.

Catch History: The peak catch of other rockfish in the EBS occurred in 1978 with a removal of 2,600 mt. In the AI region, peak catch occurred in 1979 with a harvest of 4,500 mt. Catches in more recent years have been lower, and mainly incidental to other deepwater fisheries. In the Gulf of Alaska, thornyheads were targeted by Japanese and Soviet trawl fisheries beginning in the mid 1960's.

Exploitable biomass (mt, from AI trawl survey), pre-season catch specifications (mt), and total catches (mt, including discards) of "other rockfish" in the BSAI, 1980-2000.

Year	AI Biomass	BS+AI ABC	BS+AI TAC	BS+AI Catch
1980	19,100	7,700	7,727	879
1981		7,700	7,727	684
1982		21,300	7,727	2,390
1983	16,000	22,000	7,727	1,265
1984		14,100	7,050	232
1985		14,100	6,620	191
1986	20,300	8,910	6,625	271
1987		1,880	1,880	621
1988		1,500	1,500	619
1989		1,500	1,500	673
1990		1,600	1,600	1,248
1991	6,400	1,325	1,325	945
1992		1,325	1,325	4,364
1993		1,325	1,190	685
1994	6,400	1,135	1,135	562
1995		1,135	1,022	849
1996		1,449	1,304	642
1997	10,081	1,087	1,087	517
1998		1,054	1,054	566
1999		1,054	1,054	760
2000		1,054	1,054	*

Atka Mackerel

Biology: Atka mackerel (*Pleurogrammus monopterygius*) is a schooling, semi-demersal species common along the Aleutian Islands. Atka mackerel begin to recruit to the fishery at age 2 and many survive to 14 years. Annual natural mortality of adults has been estimated to be about 25% ($M = 0.30$). Females reach 50% maturity at 31 cm (about 3.6 years old). Atka mackerel migrate from the shelf edge to shallow coastal waters (5-30 m) to spawn. Spawning occurs in July to September along the Aleutian Islands. Eggs are adhesive and deposited in rock crevices. These nests are guarded by the males until hatching, which occurs about 40-45 days later. Atka mackerel eat copepods and euphausiids, and in turn are prey for other fish, seabirds, Steller sea lions, and other marine mammals.

Stock Assessment: The current Atka mackerel assessment is based on a stock synthesis model. Estimates of B_{msy} and F_{msy} are not available for this stock. OFL and ABC rates are based on tiers defined under Amendment 56. Under this definition, 2000 OFL for Atka mackerel is based on a tier 3a fishing mortality rate where $F_{OFL} = F_{35\%}$ ($=0.42$). ABC is based on a tier 3a harvest strategy where $F_{ABC} = F_{40\%}$ adjusted more conservatively ($=0.23$).

Population Status: For 2000, exploitable biomass in the Aleutian Islands area was projected at 565,000 mt. Catch specifications were the following: OFL=119,000 mt, ABC=70,800 mt, TAC=70,800 mt. Biomass of Atka mackerel peaked in 1991, bolstered by strong year-classes produced in 1984-1986 and a very strong 1988 year-class. The most recent assessment indicates that this stock is on a downward trend. The 1992 year class was above average, but more recent year-classes have been small

! Not Overfished
! Above Target Biomass
! Declining Stock Size

Fishery: Atka mackerel are targeted by catcher processor trawlers. Participants in the 1998 fishery included 14 catcher processors. Fishing for Atka mackerel is concentrated on very discrete areas, such as Seguam Bank, Tanaga Pass, Oglala Pass, and Tahoma Reef.

Management: The Atka mackerel fishery is regulated under the BSAI Groundfish FMP. The FMP controls the fishery through permits and limited entry, catch quotas (TACs), seasons, in-season adjustments, gear restrictions, closed waters, bycatch limits and rates, allocations, regulatory areas, record keeping and reporting requirements, and observer monitoring. Seven and one-half percent of the TAC is allocated to CDQ groups. Beginning in 1994, with passage of Amendment 28, the Atka mackerel TAC was apportioned among AI subareas. Amendment 34 set aside 2% of the TAC for vessels using jig gear. Beginning in 1999, a regulatory amendment required that TAC be allocated inside and outside of Steller sea lion critical habitat to reduce potential competition.

Economics: In 1999, 53,000 mt of Atka mackerel was caught in the Aleutian Islands areas, of which about 48,000 mt was retained. Average ex-vessel price was about \$0.12 per pound. Primary products produced are H&G and whole fish.

Catch History: Atka mackerel were targeted by the vessels from USSR, Japan, and Korea during the 1970's. Catches peaked at 24,000 mt during this time period. Foreign fisheries were replaced by joint-ventures during the 1980's. The fishery has been fully domestic since 1990, and catches have fluctuated in response to TACs.

Exploitable biomass (mt, age 3+ hindcast from 1999 Synthesis model), pre-season catch specifications (mt), and total catches (mt, including discards) of Atka mackerel in the Aleutian Islands, 1980-2000.

Year	AI Biomass	AI ABC	AI TAC	AI Catch
1980	962,000	24,800	24,800	15,533
1981	992,000	24,800	24,800	16,661
1982	927,000	24,800	24,800	19,546
1983	851,000	25,500	24,800	11,585
1984	755,000	25,500	24,130	35,998
1985	688,000	37,700	37,700	37,856
1986	695,000	30,800	30,800	31,978
1987	888,000	30,800	30,800	30,049
1988	1,013,000	21,000	21,000	21,656
1989	1,188,000	21,000	20,285	14,868
1990	1,156,000	24,000	21,000	21,725
1991	1,381,000	24,000	24,000	22,258
1992	1,302,000	43,000	43,000	46,831
1993	1,117,000	117,100	32,000	65,805
1994	1,106,000	122,500	68,000	69,401
1995	1,016,000	125,000	80,000	81,214
1996	846,000	116,000	106,157	103,867
1997	679,000	66,700	66,700	65,845
1998	613,000	64,300	64,300	55,782
1999	588,000	73,300	66,400	53,000
2000	565,000	70,800	70,800	*

Squid

Biology: Two main squid species are found in the BSAI. *Berryteuthis magister* is the principle species in the Bering Sea and *Onychoteuthis borealijaponicus* predominates catches in the Aleutian Islands area. Information on the abundance, distribution, and general biology of these squids is lacking. Squid are prey for fish and marine mammals (such as Steller sea lions, northern fur seals, harbor seals, and beaked whales).

Stock Assessment: The current assessment for squid is based on fishery catches only. B_{msy} and F_{msy} have not been estimated for the squid stock. OFL and ABC rates are based on tiers defined under Amendment 56. Under this definition, OFL is based on a tier 6 fishing mortality rate where OFL= average catch from 1978-1995. ABC is based on a tier 6 harvest strategy where ABC= 0.75 x average catch from 1978-1995.

Population Status: Estimates of squid biomass are not available. Because squid are pelagic, the NMFS bottom trawl survey does not adequately sample this species to generate realistic biomass estimates. For 2000, catch specifications were the following: OFL=2,620 mt, ABC=1,970 mt, TAC=1,970 mt.

! Not Overfished
! Target Biomass unspecified
! Stock Size unknown

Fishery: Squid are not a target species in the Bering Sea, although they are taken as bycatch in the pelagic trawl fishery for pollock. They are also taken in smaller numbers in trawl fisheries for pollock, rockfish, and Greenland turbot.

Management: Squid is a defined target species that is regulated under the BSAI Groundfish FMP. The FMP controls the fishery through permits and limited entry, catch quotas (TACs), seasons, in-season adjustments, gear restrictions, closed waters, bycatch limits and rates, allocations, regulatory areas, record keeping and reporting requirements, and observer monitoring. To allow CDQ groups to fully harvest their pollock allowance, the Council adopted a regulation that removed squid as a CDQ species in 1999.

Economics: In 1999, 400 mt of squid was caught in the BSAI, of which nearly all was discarded. Discard rates in 1992-1994 fisheries ranged from 40% to 85%. Squid are generally frozen whole and used for bait or for human consumption.

Catch History: Squid were targeted by Japanese and Republic of Korea trawl fisheries during the 1960s and 1970s. Catch peaked in 1978 at 9,000 mt and steadily declined thereafter. Since 1986, less than 1,000 mt have been taken annually.

Exploitable biomass (mt), pre-season catch specifications (mt), and total catches (mt, including discards) of squid in the BSAI, 1980-2000.

Year	BSAI Biomass	BSAI ABC	BSAI TAC	BSAI Catch
1980	N/A	10,000	10,000	6,372
1981	N/A	10,000	10,000	5,945
1982	N/A	10,000	10,000	5,039
1983	N/A	10,000	10,000	3,980
1984	N/A	10,000	8,900	3,167
1985	N/A	10,000	10,000	1,620
1986	N/A	10,000	5,000	868
1987	N/A	10,000	500	131
1988	N/A	10,000	1,000	417
1989	N/A	10,000	1,000	306
1990	N/A	10,000	500	626
1991	N/A	3,800	1,000	632
1992	N/A	3,600	2,000	880
1993	N/A	3,400	2,000	683
1994	N/A	3,400	3,110	604
1995	N/A	3,110	1,000	459
1996	N/A	3,000	1,000	1,167
1997	N/A	1,970	1,970	1,474
1998	N/A	1,970	1,970	908
1999	N/A	1,970	1,970	400
2000	N/A	1,970	1,970	*

Other Species

Biology: The "other species" category includes species that currently have minimal commercial value such as sculpins, skates, sharks, and octopi. Skate species include Alaska skate (*Bathyraja pamifera*), big skate (*Raja binoculata*), longnose skate (*R. rhina*), starry skate (*R. stellulata*), and Aleutian skate (*B. aleutica*). The predominant shark species is spiny dogfish (*Squalus acanthias*), with sleeper sharks (*Somnius pacificus*) occasionally taken. Octopus species include *Octopus dofleini* and *Opisthoteuthis califolia*. Many species in this assemblage (smelts, in particular) are important prey for groundfish, seabirds, and marine mammals.

Stock Assessment: The current assessment is based on abundance estimates from the NMFS bottom trawl surveys. B_{msy} and F_{msy} have not been estimated for any species in this complex. OFL and ABC rates are based on tiers defined under Amendment 56. Under this definition, OFL for other species is based on a tier 5 fishing mortality rate where $F_{OFL} = M (=0.20)$. ABC is based on a tier 5 (adjusted) harvest strategy where $ABC = 0.75 \times M$. The ABC is being increased to maximum ABC by incremental steps over a 10 year period. Year 2000 represents step two in the process.

Population Status: The overall complex biomass appears to be stable in the Eastern Bering Sea. For 2000, biomass was projected to be 611,000 mt. Catch specifications were: OFL=71,500 mt, ABC=31,360 mt, TAC=31,360 mt.

! Not Overfished
! Target Biomass unspecified
! Stable Stock Size

Fishery: Other species are taken incidentally in other target fisheries. Octopus are caught as bycatch in the pollock bottom trawl fishery and Pacific cod fisheries (using pots, trawls, and longlines). Sharks are taken in the pelagic trawl pollock fishery and in the longline fisheries for sablefish, Greenland turbot, and Pacific cod. Skates are primarily taken in the Pacific cod longline fishery, as well as pollock and flatfish bottom trawl fisheries. Sculpins are caught as bycatch in nearly every bottom trawl fishery.

Management: Other species are regulated under the BSAI Groundfish FMP. The FMP controls the fishery through permits and limited entry, catch quotas (TACs), seasons, in-season adjustments, gear restrictions, closed waters, bycatch limits and rates, allocations, regulatory areas, record keeping and reporting requirements, and observer monitoring. The "other species" category includes species that currently have only slight economic value such as sculpins, skates, smelts, sharks, and octopus. Because sufficient data are lacking to manage each species separately, a single TAC is specified for this category as a whole. Seven and one-half percent of the TAC is allocated to CDQ groups. Amendment 36 removed capelin and other forage fish from the "other species" category, beginning in 1999. Numerous other fish and invertebrates (such as grenadiers, eelpouts, sandfish, sea urchins, and mussels) which are not commercially harvested in the EEZ are included in a "nonspecified" category and no TAC is established.

Economics: Other species are of limited commercial value, and are generally discarded. In 1999, 18,000 mt of other species was caught, but only about 1,000 mt was retained. The primary product is meal, however, some skates have been processed into wings.

Catch History: Catches of "other species" increased during the 1960s to peak at 133,000 mt in 1972. Not surprisingly, this was also the peak year for all species of groundfish in the BSAI. Catches of "other species" remained relatively high through the mid and late 1970s (30,000-73,000 mt), but declined thereafter. Since 1990, catches have ranged from 17,000-33,000 mt, representing 2% or less of the total BSAI groundfish catches.

Biomass (mt, from NMFS trawl surveys), pre-season catch specifications (mt), and total catches (mt, including discards) of "other species" in the BSAI, 1980-2000. Specifications included smelt through 1998.

Year	EBS Biomass	BSAI ABC	BSAI TAC	BSAI Catch
1980	450,900	74,200	74,249	47,661
1981	345,300	94,400	74,249	42,925
1982	533,100	94,300	74,249	23,367
1983	472,300	61,400	77,314	19,140
1984	446,500	61,000	40,000	10,178
1985	334,250	51,200	37,980	13,553
1986	573,100	35,900	27,800	11,980
1987	556,700	49,500	15,000	9,724
1988	713,900	54,000	10,000	12,643
1989	632,500	59,000	13,264	5,101
1990	827,400	55,500	5,000	20,808
1991	762,400	28,700	15,000	17,199
1992	617,505	27,200	20,000	33,075
1993	618,388	26,600	26,600	23,851
1994	691,067	27,500	26,390	24,555
1995	621,987	27,600	20,000	22,213
1996	620,997	27,600	20,125	21,437
1997	618,709	25,800	25,800	25,176
1998	669,000	25,800	25,800	23,448
1999	643,000	32,860	32,860	18,000